The Spectra of Aurora and Corona

So much attention has been drawn to the correspondence between the spectrum of the corona and that of the aurora, as to lead one to suppose that they were almost identical; or, at least, that the principal auroral line was also seen in the corona. But even this is not at all the case. As the readers of NATURE are aware, the light of the aurora is almost monochromatic, giving a spectrum of one bright line in the yellowish green (wave-length about 557), and three or four very faint bands, which are more refrangible. These last are only occasionally visible, and indeed, Angström, in 1869, had seen them but once, and that momentarily. It is with one of these faint bands that the 1,474 corona line (wave length 531·6) is said to coincide, and not with the bright line (wave length 557), which is entirely absent in the corona spectrum. Two more of the auroral bands are near to the F and G hydrogen lines, which are visible in the corona, but it is yet doubtful whether they coincide. It is not impossible that a faint H spectrum may be produced in the aurora by the moisture of the air, but I incline to attribute them to the low temperature air spectrum mentioned in my letter of February 7, and which has bands in nearly the same positions. From the extreme faintness of the auroral bands, it is of course impossible to measure their positions with great accuracy.

Under these circumstances it would seem rather premature to lay great weight on the supposed coincidence, and much careful work must be done both on gas spectra and on that of the aurora before we can say with any confidence that these lines are not due to gases already known to us under different circumstances of temperature and density.

I subjoin a table, giving the approximate wave lengths of the lines observed in the auroral and coronal spectra.

Lines of Corona and Prominences.		Lines of Aurora.		Observers.
Description	Wave length	Description	Wav elength	
C Hydrogen	636			
		Bright line.	630 640*	H. R. Procter and others.
D Sodium	589			
D_3				
		Bright line.	556·7 557 569†	Angström Winlock Alvan Clarke, jun.
1474 line	531·6	band	531 532	Winlock Alvan Clarke, jun.
E	527			
		band	520	Winlock
b	517			
F Hydrogen	486	band	485	Alvan Clarke, jun.
		band	464	Winlock
G Hydrogen	435	band	434	Alvan Clarke, jun.

HENRY R. PROCTER

Royal College of Chemistry, March 28

The Aurora

THE splendid aurora which was visible here last night was probably seen in many other places, and from a comparison of data, perhaps the position of the luminous arch, which formed a conspicuous part of it as seen from here, may be made out.

At 10.30 it passed through the northern part of Corona, 12 Canum Venaticorum, and the head of Leo. At the time mentioned above, the whole of the light was a vivid green, but at about 10.40 red patches appeared, and at 10.45 rays shot up to a point situated about 4° S.S.W. of 12 Canum. The colour round this point was a most wonderfully dark blood red, and in many other parts of the heavens the same colour was seen, very different from the rosy light of last October.

About 11 clouds coming up covered the whole sky, and on their partially clearing away, the aurora was much decreased in brilliancy. The lurid red light reflected from the detached clouds which preceded the main body produced an exceedingly grand effect. The light was strong enough to read type of the size in which NATURE is printed.

On first observing the green parts with a spectroscope of one bisulphide prism, the only line distinctly visible was the green one; but by watching and opening the slit there came into view two bands at the more refrangible end, more sharply defined at the more refrangible side than at the other, and there also seemed to be a considerable continuous spectrum from the green line nearly to the least refrangible of the two bands.

In the red parts the red line was most brilliant, quite equal in intensity to the green one, and then even in the green light it was distinguishable with care and long watching.

York, April 10 T. H. WALLER

LAST evening, at about 9.50, my attention was called to a magnificent display of aurora borealis. A mass of light, composed of red and bluish-white streamers or rays, moved rapidly up from about W.S.W. to E.N.E., and the whole took the form of an arch overhanging for a short space of time the western horizon, while transverse waves of light, intensifying the lustre of the blue portions, and occasionally reaching almost to the zenith, rolled across the nebulous mass at intervals of about a second. Streamers projecting eastwards kept shooting out with great brilliancy, like sheet lightning, except that they were separated by a sharp line from the dark surrounding sky. Each flash made a fresh advance eastwards, like the skirmishers preceding an army, and a few bright crimson clouds alone kept nearly the same position throughout the display,—the finest of these was nearly in the S.W. At one time, when the flashes and waves had ceased, an umbrella-like radiation of red and white rays from the zenith attained great beauty. By five minutes past ten the sky had regained a more ordinary hue, but dull red clouds still remained, and in the west a white phosphorescence like early dawn. The night was calm and rather cold; the barometer 30·00 and steady. The wind had been gusty from E. in the afternoon. I had remarked during the daytime some very rare and beautiful modifications of cirrus and wave-cloud stretching from W.S.W. to E.N.E. (a direction coinciding with that of the aurora streamers), and crossed by bars at right angles to them at a lower elevation. The arrangement of these clouds showed that they were strongly acted on by electricity, as is generally, perhaps, the case with wave-cloud. May not vapours of this kind in a peculiar state produce the apparent polarisation of the sun's rays recorded by "'J. W." in the *Times* of April 8? To-day, especially, between twelve and one o'clock, detached cumuli, driving rapidly from about E.S.E. and upper cirro-cumuli from E.N.E., have behaved in a manner quite unlike anything I have observed before. The only cirro-cumulus to be seen in the morning shot out branches in advancing and melted away between the branches, leaving a sort of skeleton of spine and ribs, which in their turn were dissipated. The cumulus motions were also unusual, for portions were suddenly arrested, remaining fixed, and then rose apparently and arranged themselves in bands more or less parallel until dissolved. The last phenomena only occurred, as far as I could see, below some whitish rays, extending across the sky from W.S.W. to E.N.E., parallel to the aurora streamers of last evening, and closely resembling the beams of light which often proceed from the sun when behind a cloud on a showery day. Either an aurora must be going on to-day, or the higher atmosphere is in a peculiar electrical state. The influence of these whitish bands on the clouds at a much lower level is at any rate remarkably powerful.

Wrexham, Denbighshire, April 10 F. R.

Solar Science at the pleasure of *Secret* Referees

IN the faithfully-recording columns of NATURE for March 30, at p. 434, is a much required abstract of Mr. Stone's important paper, recently communicated by him to the Royal Society, London, on the connection between terrestrial temperature and sun-spot phenomena. By comparing the curves of mean annual temperatures during the last thirty years (as observed, ready to his hand, by his indefatigable predecessor Sir Thomas Maclear) with another curve constructed on Wolf's observations of sun-spots, Mr. Stone has been enabled to deduce, almost immediately after arriving on his new scene of labour at the Cape of Good Hope, first, that there is an approximately decennial period of such temperature, and so similar to that of the sun-spots as to indicate more than a mere coincidence; and secondly, that the sun-spots are not to be looked on as the direct ages of thent temperature variation, but that either phenomenon results from some general change of solar energy.

As Mr. Stone expressly mentions "that he had not the slightest expectation, on first laying down the curves, of any sensible agreement resulting," I presume that he is not aware that upwards of a year ago I both sought the honour and experienced

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* Seen on October 26 last year, but very rarely visible.

† Prof. Pickering considers this an error. My own measures give a wave length very slightly greater than those of Winlock and Angström.

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the grief of communicating to the self-same Royal Society of London an almost exactly similar research, resulting in almost the same solar conclusion; my foundation matter being the mean annual rock-temperatures observed in the Royal Observatory, Edinburgh, during thirty-three years (twenty-four of them under my own supervision) with the recorded sun-spot and other solar phenomena by Schwabe, Wolf, the Kew Observatory, and other authorities, during the same period.

And yet why was Mr. Stone *not* acquainted with this previous work of mine, communicated to the very same London Society, at a time too when he was still in London or very close to it?

The answer is probably, that it was the work of the *Secret* Committee of the Royal Society appointed by the Council to report on my paper. For the Committee's first proceeding was to keep the paper shut up with themselves for upwards of seven months; and their next, to condemn it before the Council on several counts, the two chief of which seemed to be—first, that I had inveighed without occasion, in a note on a certain page, *against* British units and standards of linear measure; and secondly, that I was not to be allowed to compare the Edinburgh mean annual temperatures with sun-spot observations.

Touching the first objection, I showed that there was no such note or sentiment throughout the whole paper; and with regard to the second, I felt scientifically constrained to declare, that I could not consent to be denied the right of comparing so long, accurate, and indeed hitherto unsurpassed, a series of earth-surface temperatures as those of the Edinburgh Observatory, with acknowledged solar phenomena; especially when confining myself to merely trying and exhibiting for annual means whether there was, or was not, any sensible correspondence in time and manner.

For this rebellious opposition to the despotic dictates of the *Secret* Committee, my paper was instantly extinguished by the Council of the Royal Society; and I was put to the further indignity of receiving an unpleasant letter from the secretary, on merely requesting to know the names of the gentlemen constituting the said Committee, whose identity in the flesh is therefore still a problem. But now, see how speedily the *Nemesis* of deeds of darkness has overtaken those who dabble in them; for the newly-appointed Astronomer Royal at the Cape of Good Hope, in charge of the British Observatory which stands next in importance to Greenwich, one of the Royal Society's own Fellows too, has, moved by some most mysterious impulse, made that very subject, just banned by the carefully concealed sages who speak from behind a curtain, the material of his first scientific communication from the Southern Hemisphere; and, with even a cruel degree of polite attention, he has sent that paper, filled with their own forbidden matter, to the Royal, rather than any other, Society in London, to read aloud before their members.

Yet this chief and leading society's secret Star-chamber, though exclaiming, perhaps, to the South African astronomer, "*Et tu, Brute,*" has not repented, at least in any generous or human manner; for they have left me both to find out from NATURE the whole character of Mr. Stone's paper just accepted by and read before them, and to form my own unaided conclusions.

Wherefore I cannot but wonder more than ever, and even with exceeding admiration, at what *any* Scientific Societies in the present day have got to do with that accursed thing in all national history represented by Secret Committees, secret members, secret judgments, *veiled* prophets, who may, and—as would most clearly be shown if the whole correspondence in this case were to be published—who do, blunder utterly in understanding a plain sentence of simple English, who likewise enact a mistaken rule to tie down some astronomers in their own business, prove themselves totally void of Christian charity and gentlemanly feeling, and all the time require the incense of passive obedience to their partial edicts and strange behests.

Is not this then a matter just as important as any that can occur in the interests of true science and unalloyed, for the Royal Commission now sitting on Scientific Education and the Advancement of Science to take account of! For, if that Commission fitly and fully represents the general government in these times of this free and enlightened land in which we live, it would seem to be one of their holiest duties to the nation at large, to see that a base political method of a past and exploded era of our history, after being driven with ignominy out of every other branch of government, be not allowed to linger in sequestered nooks and dark corners of State-supported or State-aided societies for scientific pursuits.

C. PIAZZI SMYTH

15, Royal Terrace, Edinburgh, March 31

Ocean Currents

MR. LAUGHTON thinks (see his letter in NATURE of April 6) that the ocean surface current, which flows into the Mediterranean by the Straits of Gibraltar, is due to the preponderance of west winds over the Atlantic. Were this so there ought to be a similar current flowing into the Baltic; but on the contrary, there is a surface-current flowing out of the Baltic.

I am convinced that Dr. Carpenter is right in accounting for the currents at the entrances of both the Mediterranean and the Baltic by the differences in the degrees of saltness of different seas.

JOSEPH JOHN MURPHY

Old Forge, Dunmurry, Co. Antrim

Sun Spots

SOME very remarkable maculæ appeared on the sun on March 28, 9^{h} 50^{m} A.M., which are of interest from the fan-like portion of the most westerly of the large spots having been much enlarged whilst under observation. The enlargement took place from the centre outwards, and occupied several seconds in its development.

W. H. WALENN

74, Brecknock Road, N.

The Echoes of the Royal Albert Hall

THE following observations may assist in reconciling some of the conflicting statements respecting the above subject, and explaining their curious discrepancies:—

The shape of the building is nearly elliptical; for the sake of description I will assume that it is a true ellipse. The middle of the platform, down which Her Majesty walked on the occasion of the opening ceremony, corresponded to the major axis of this ellipse, the seats in the arena were arranged in rows at right angles to the major axis, and thus the middle row of these seats was placed across the minor axis. I sat on one of the chairs of this middle row, that against the edge of the platform, and thus was in the nearest available place to the geometrical centre of the building, and therefore well situated for one set of acoustic observations. I listened very carefully, and made the following notes:—

An invisible military band was playing for some time before the arrival of the Queen. This music was freely heard without any perceptible echo, but the outlines of the sound (if I may use such an expression) were slightly shaded, there was just that want of crispness and definition of individual sound which would be advantageous to an ill-timed band, but somewhat damaging to the display of one that was playing staccato passages with perfect unity.

When the Prince of Wales read his address I heard every word repeated with perfect distinctness, the echo was pure and single, the two voices appeared like those of a prompter and a faithfully repeating speaker. The echo was remarkably well defined, and nearly as loud as the voice of the Prince.

When the Queen replied, her words were also repeated, but far less distinctly. This was a respectful whispering echo. When Santley sang a solo, there was no distinct echo, only a slight confusion of sound; but every note of Madame Sherrington's solo was most vexatiously mocked, but not so distinctly as the words of the Prince of Wales. A slight murmur accompanied the band, but it required a strain of attention to detect any definite echo.

The above is a description only of what I heard.

A friend who was sitting at the other end of one of the middle arena seats, *i.e.* near the boxes, or circumference of the ellipse, did not hear these echoes at all, and I have since learned that this was the case with others seated in boxes on either side of the hall.

The explanation of these facts is not difficult. On both sides of the organ, which occupied the south end or vertex of the ellipse, are unbroken curved wall spaces above the choir, covered with wooden panels or lining, a material well adapted for the reflection of sound. Beyond these bare spaces the boxes begin, and extend round the circumference till they reach the bare wall-space on the opposite side. There can be no regular reflection from the large area covered by the boxes when these are filled with people, but there must be such regular reflection very distinctly effected by the small bare portion of the curvature on each side of the organ.

If the curvature of this bare wooden wall-space were a true parabola, and a sound were emitted from the focus of the curve, it would be reflected in straight lines parallel to the axis, and only extending to a short distance on each side of it. With the

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